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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/089,017	07/19/2002	Ralph Wirth	12406-022001	5521

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Fish & Richardson
225 Franklin Street
Boston, MA 02110-2804

EXAMINER	
DOLAN, JENNIFER M	

ART UNIT	PAPER NUMBER
2813	

DATE MAILED: 10/22/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/089,017	WIRTH ET AL.	
	Examiner	Art Unit	
	Jennifer M. Dolan	2813	

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address* --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *30 July 2003* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-14* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-14* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1, 6-9, 13, and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 5,779,924 to Krames et al. (cited by applicant) in view of U.S. Patent No. 5,744,828 to Nozaki et al.

Regarding claims 1 and 14, Krames discloses a light emitting diode, comprising: a semiconductor layer structure including a substrate (3) and at least one light-generating layer (2) formed on the substrate (figure 7c). Krames further discloses a transparent semiconductor epitaxial layer (1), deposited on the light generating layer (figure 7c), a first electrical contact layer (4) on the back of the substrate (see figure 7c), and a second electrical contact layer (4, portion on top of layer 1) deposited on the semiconductor epitaxial layer, characterized in that the top surface of the semiconductor epitaxial layer has vertical structuring to improve the decoupling of light (figure 7c; see column 3, lines 1-20; column 6, lines 25-52). The semiconductor epitaxial layer (1) of Krames is considered to act as a current-spreading layer, since the current-spreading layer is typically a thin semiconductor layer with low resistivity, such as an AlGaAs layer, similar to that disclosed by Krames. Assuming arguendo, the epitaxial layer of Krames does not constitute a current spreading layer.

Krames further fails to disclose that the second electrical contact provides substantially uniform coupling of the current into the current spreading layer, and that the second contact layer has a circumferential contact web structure.

Nozaki discloses a LED using a transparent current spreading layer (6) and having a second electrical contact (20) with a lateral structure (figure 1) by means of which substantially uniform coupling of the electrical current into the current-spreading layer can be achieved (see column 2, lines 12-60, column 7, lines 20-30). Nozaki further teaches that the second contact layer has a circumferential web arranged about a central contact structure (figures 1 and 8).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the LED structure of Krames, such that it includes a current spreading layer and an upper electrode with a lateral structure for uniform current coupling, as taught by Nozaki. The rationale is as follows: One of ordinary skill in the art at the time the invention was made would have been motivated to provide a current spreading layer and an electrode with lateral structure, because combination of the current spreading layer and laterally disposed electrode structure allows for an even current distribution across the entire surface of the light emitting layer, which results in improved luminous efficiency and brightness (see Nozaki, column 2, lines 12-60, column 7, lines 20-30).

Regarding claim 6, Krames, as modified by Nozaki, discloses that the second electrical contact layer (Krames, 4,9 adjacent to layer 1) is arranged on structured (see Krames, figs. 10-11) and/or unstructured portions of the current spreading layer (Krames, figure 7c).

Regarding claims 7 and 13, Krames discloses that the vertical structuring is in the form of regularly arranged cones (column 6, lines 25-30; figures 5a-5c).

Regarding claims 8 and 9, Krames discloses a method for fabricating a LED, such that a light generating layer (2) and thereafter an upper cladding layer which is considered to act as a current spreading layer (the layer is made of AlGaAs, which is a typical current spreading material, is thick, transparent, and meets the requirements for a current spreading layer as established in the specification of the present application) are deposited on a substrate (3) and the back of the substrate is provided with a first contact layer (4). Krames further teaches both the cases where vertical structuring is performed, and then the second contact layer is deposited on the structured surface (see figures 10-13); and the case where the second contact layer with a desired lateral structure is first provided, and then vertical structuring takes place (figures 7a-7c, 8). Krames fails to specifically point out, however, that the upper cladding material is a current spreading layer. Assuming arguendo, the upper cladding material does not sufficiently act as a current spreading layer.

Nozaki discloses an LED having a light emitting layer (4) with a current spreading layer (6) provided on top.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the method of Krames, such that a current spreading layer is provided in addition to the light emitting structure, as taught by Nozaki. The rationale is as follows: One of ordinary skill in the art at the time the invention was made would have been motivated to provide a current spreading layer, because doing so helps to widely diffuse the supplied current to the whole device, thus improving light emission efficiency and brightness (see Nozaki, column 2, lines 12-18).

3. Claims 1-4, 10, and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nozaki et al. in view of Krames et al.

Regarding claim 1, Nozaki discloses an LED having a substrate (1) and at least one light generating layer (4) formed on the substrate and one transparent current spreading layer (6) deposited on the light generating layer (figure 2), a first electrical contact (9) on the back of the substrate (figure 2); and a second electrical contact (20, 21, 22) on the current spreading layer (figure 2), where the second electrical contact layer has a lateral structure by means of which substantially uniform coupling of the current into the current spreading layer can be achieved (figure 1; column 2, lines 12-18).

Nozaki fails to teach that the current spreading layer has vertical structuring to improve the decoupling of light.

Krames teaches an LED having ordered interface texturing (figure 7c) to improve the decoupling of light (column 2, line 65 – column 3, line 20; column 4, line 16- column 6, line 50).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the LED of Nozaki by vertically structuring the current spreading layer, as suggested by Krames. The rationale is as follows: One of ordinary skill in the art at the time the invention was made would have been motivated to vertically texture the current spreading layer, because Nozaki shows that the current spreading layer is the outermost layer of the device (i.e. interfacing with air since layer 7 is removed; see Nozaki, column 5, lines 1-10), and Krames shows that texturing the outermost layer leads to improved transmission/extraction efficiency of the LED (see Krames, column 2, line 65 – column 3, line 20).

Regarding claims 2 and 10, Nozaki discloses that the second contact layer has a circular central contact surface with a contact structure rotationally symmetrical with respect to the center point of the central contact surface, and is composed of relatively narrow contact webs (figure 1).

Regarding claim 3, Nozaki shows 4-fold symmetry (figure 1).

Regarding claim 4, Nozaki shows that the second contact layer is continuous (figure 1).

Regarding claim 12, Nozaki shows that the rotational symmetry of the second contact and that of the LED are both the same (4-fold; see figure 1).

4. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nozaki et al. in view of Krames et al. as applied to claim 1 above, and further in view of U.S. Patent No. 6,107,644 to Shakuda et al.

Nozaki as modified by Krames, fails to disclose a discontinuous second electrical contact.

Shakuda discloses that the second electrical contact (8b) for an LED may be equivalently continuous (figure 6b) or discontinuous (figures 7a, 7b) and interconnected by a layer of transparent, light-conducting material (7; figure 6a).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the electrode of Nozaki as modified by Krames, such that it is discontinuous, as taught by Shakuda. The rationale is as follows: One of ordinary skill in the art at the time the invention was made would have been motivated to provide a discontinuous electrode, because Shakuda shows that discontinuous and continuous electrodes may be equivalently employed for providing uniform current distribution to an LED (see Shakuda, column 2, lines 40-46; column 12, lines 21-34; figures 6b, 7a, 7b).

5. Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nozaki et al. in view of Krames et al. as applied to claim 2 above, and further in view of European Patent Application 0 544 512 to Watanabo et al.

Nozaki teaches a circular central contact surface (figure 1), but fails to disclose a square shaped central contact surface.

Watanabo discloses both circular (figures 5, 7, and 9) and square shaped (figures 10, 12, and 13) central contact surfaces.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the second contact surface of Nozaki as modified by Krames, such that the central contact surface is square shaped, as taught by Watanabo. The rationale is as follows: One of ordinary skill in the art at the time the invention was made would have been motivated to provide a square shaped central contact surface, because Watanabo shows that both circular and square shaped central contact surfaces are recognized art equivalents, and thus can be used interchangeably for laterally structured LED contacts (see figures 5, 7, 9, 10, 12, 13).

6. Claims 1 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Japanese Patent Publication No. 07-162037 to Nishitani in view of Nozaki et al.

Nishitani discloses a light emitting diode, comprising: a semiconductor layer structure including a substrate (101) and at least one light-generating layer (105) formed on the substrate (figure 4). Nishitani further discloses a current spreading layer (107) deposited on the light generating layer; a first electrical contact layer (109) on the back of the substrate; and a second

electrical contact layer (108) deposited on the semiconductor epitaxial layer, characterized in that the top surface of the semiconductor epitaxial layer has vertical structuring to improve the decoupling of light (see figure 4; abstract).

Nishitani fails to disclose that the second electrical contact provides substantially uniform coupling of the current into the current spreading layer, and that the second contact layer has a circumferential contact web structure.

Nozaki discloses a LED having a second electrical contact (20) with a lateral structure (figure 1) by means of which substantially uniform coupling of the electrical current into the current-spreading layer can be achieved (see column 2, lines 12-60, column 7, lines 20-30). Nozaki further teaches that the second contact layer has a circumferential web arranged about a central contact structure (figures 1 and 8).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the LED structure of Nishitani, such that it includes an upper electrode with a lateral structure for uniform current coupling, as taught by Nozaki. The rationale is as follows: One of ordinary skill in the art at the time the invention was made would have been motivated to provide a current spreading layer and an electrode with lateral structure, because a laterally disposed electrode structure allows for an even current distribution across the entire surface of the light emitting layer, which results in improved luminous efficiency and brightness (see Nozaki, column 2, lines 12-60, column 7, lines 20-30).

Response to Arguments

7. Applicant's arguments with respect to claims 1-9 have been considered but are moot in view of the new grounds of rejection.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jennifer M. Dolan whose telephone number is (703) 305-3233. The examiner can normally be reached on Monday-Friday 8:30am-5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl W. Whitehead, Jr. can be reached on (703) 308-4940. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

Jennifer M. Dolan
Examiner
Art Unit 2813

jmd

Carl W. Whitehead

CARL WHITEHEAD JR.
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800